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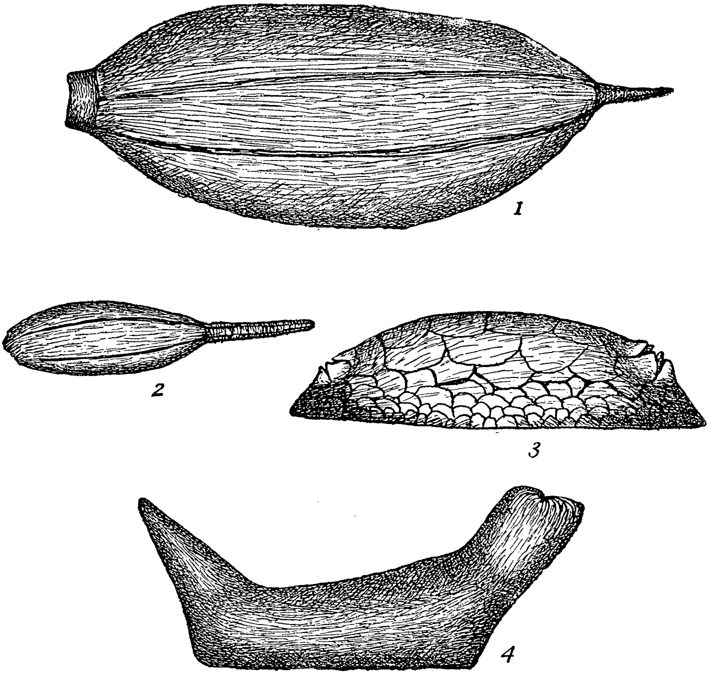
SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

XV. The Holothurioidea.

HUBERT LYMAN CLARK.

The holothurians form a sharply defined group of marine invertebrates, especially abundant in the tropics but well represented in both temperate and polar seas. About six hundred species are known, varying in size from ten millimeters to almost a meter in length, and some of the largest species are thirty or forty centimeters in circumference. The colors vary greatly but generally are not brilliant, some shade of brown or gray being the most frequent. Red, however, of various shades is not rare, and green and yellow are also not infrequent. Wholly black or white forms are not uncommon. The shape is often worm-like but is more commonly broader and thicker, often resembling a cucumber, so that the name "sea cucumbers" is frequently given to the group. They are found at all depths, from high-water mark to the bottom of abysses 2900 fathoms from the surface. They are generally sluggish in their movements, and very few forms have any means of rapid locomotion. They feed almost wholly on the organic matter found in the mud or sand where they live, though a few species found among rocks seem to feed upon organic matter growing on the rocks or brought to them in the water. Some species, especially the large ones, live on the bottom where it is muddy or sandy, creeping about very slowly and apparently molested by few enemies. Others, especially the footless forms, live buried in the mud or sand, where they burrow by means of their tentacles and muscular movements of the body wall. Still others occur under or among rocks, often snugly stowed away in some hole or crevice, where they seem to be permanently settled and whence they can only be dislodged by breaking the rock.

Holothurians are easily distinguished from any other invertebrates by the anterior and usually terminal mouth, with a circumoral ring of tentacles, and their curious combination of radial and bilateral symmetry. Although the bilateral symmetry seems usually to predominate, there are always five prominent longitudinal muscles accompanied by nerve strands and vessels of one or more sorts. The body wall is soft or leathery, and generally contains calcareous particles in greater or less abundance. These particles are usually microscopic but are occasionally in the form of large plates several millimeters across. Their size, shape, and arrangement differ to an extraordinary degree in the various genera and species, and they form one of the most satisfactory means of identification. In their simplest condition these calcareous deposits take the form of very minute, more or less irregular grains known as

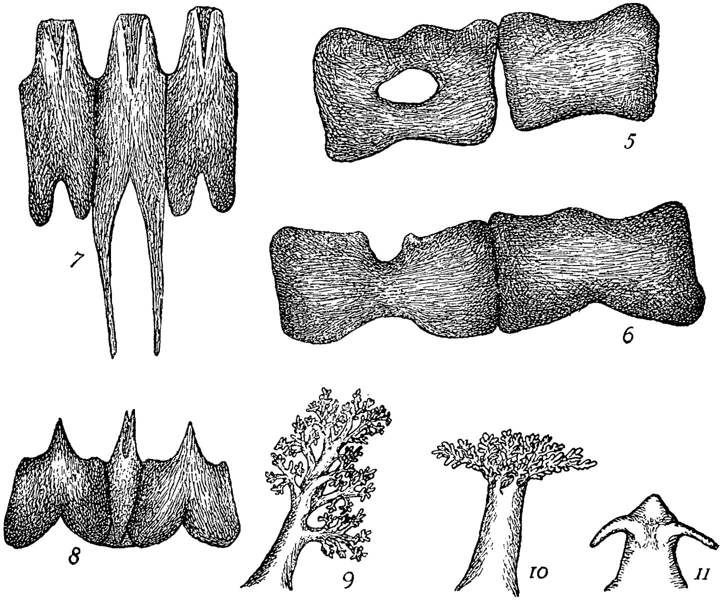


FIGS. 1-4.

1. *Trochostoma boreale* (Sars). Nat. size.
2. *Caudina arenata* (Gould). Nat. size.
3. *Psolus chitonoides* Clark. Nat. size.
4. *Psolus phantapus* (Struss.). ½ nat. size.

miliary granules, or somewhat larger straight or curved *rods*, which are often widened and perforated at the end. These rods are almost invariably present in the pedicels, papillæ, and tentacles, and are then known as *supporting rods*. In other parts of the body wall they often are more or less irregularly and profusely branched and then form *rosettes* (Fig. 26). Sometimes the deposits are flat, thin, and wide, and are called *plates*, which may be perforated with smooth-edged holes (Fig. 19), or the holes may have teeth on the edges (Fig. 13). If a perforated plate has a projection rising perpendicularly from the middle, made up of several rods more or less joined together, it is called a *table* (Figs. 15–17, 23–25); the perforated plate being called the *disk* and the projection the *spire*. Sometimes tables occur with the disk reduced or wholly wanting, and sometimes the spire is greatly reduced. Very often the perforated plates are oval or elliptical in shape, with the perforations regularly arranged in pairs, and they are then called *buttons* (Fig. 27); these may be smooth, knobbed, or spiny. Quite often the calcareous particles assume the shape of some familiar object, from which they receive names; as *anchors* (Fig. 12), *wheels* (Fig. 14), *cups* (Figs. 20–22), etc. In a few species these calcareous deposits seem to be wholly wanting; in some they are confined to special regions of the body; in many, two or more different kinds are found, usually in separate layers of the body wall; and in a few they are so abundant, or so large and close together, as to make the body wall stiff, and sometimes firm, or even rigid. Beside these colorless calcareous deposits, we find in a few genera (Trochostoma and its allies) reddish-brown or claret-colored concretions (Fig. 18), which are often so abundant as to give their color to the whole animal, or at least to large spots and patches. In such species the calcareous deposits themselves are often deeply tinged with the same coloring matter as the concretions, but usually they are free from it. In a few genera prominent tooth-like bits of lime, usually five in number, are grouped around the anus. These are called *anal teeth*.

Around the œsophagus is a ring made up of plates of lime, known as the *calcareous ring*. There are usually ten of these plates; five serve as points of attachment for the radial muscles and are called *radial pieces*, while the five which alternate with them are called *interradial.* The size and shape of these pieces differ greatly, the most important difference being whether they have *posterior prolongations* (Fig. 7) or not (Fig. 8). The tentacles around the mouth vary greatly in number and appearance. There are usually ten or twenty, but species are known which have normally eight, eleven, twelve, fifteen, eighteen, and twenty-five, and in individual cases the number runs up to thirty. In some species the number is very constant, and individual diversity is quite rare; while in other species the amount of diversity is extraordinary, ranging in some species of *Holothuria* which have normally twenty tentacles, from twelve to twenty-nine. In appearance the tentacles may be simple, finger-like, and unbranched, but this condition is very uncommon. Usually each tentacle has several to many branches; when these all arise in a tuft from near or at the tip and are more or less subdivided, the tentacle is called *peltate* (Fig. 10); when the branches occur regularly along the sides in two opposite series and without subdivisions, the tentacle is *pinnate*, or, if the branches are very few and all arise from the tip, *digitate* (Fig. 11); when the branches are subdivided and irregularly arranged the tentacle is said to be *dendroid* (Fig. 9). In some species these tentacles are used for locomotion, but they are more commonly used as feelers and to carry food to the mouth. Locomotion is generally accomplished by means of *ambulacral-* or *tube-feet*, as in the other echinoderms. These feet, when present, may be arranged in regular rows along the five radii (*ambulacra*), or scattered more or less irregularly over the whole body surface. Frequently those on the upper side of the animal are very different in size, appearance, and structure from those on the under or ventral side, and no longer serve for locomotion, the terminal sucking disk being generally absent. They are then called *papillæ*, the true-feet being *pedicels*. Rarely, all the tube-feet are papillæ and no pedicels normally occur. The papillæ are often situated on warts or tubercles, and these are sometimes of considerable size. The pedicels are frequently confined to the ventral surface and are there often arranged in three broad longitudinal series. Many holothurians have a pair of long, much-branched outgrowths of the wall of the cloaca lying in the body cavity, one on each side of the intestine. These serve for excretion, and perhaps for respiration, and are called the *respiratory trees*. Their presence or absence is of importance in classification. The stomach and anterior portion of the intestine are held in position by a thin membrane attached to the body wall in the mid-dorsal line, and called the dorsal *mesentery*. In this lies the genital duct, and the genital glands lie in groups or tufts either on one or both sides of it. In some holothurians the long radial muscles are divided anteriorly, one-half continuing attached to the body wall and serving merely as a longitudinal muscle, while the other is free



FIGS. 5–11.

5. A radial and interradial piece of the calcareous ring of *Synapta inhærens* (O. F. Müll.). × 45.
6. The same of *Synapta roseola* (Verr.). × 45.
7. A radial and two interradial pieces of a "calcareous ring with posterior prolongations." *Thyone briareus* (Less.). × 3.
8. The same of a "calcareous ring without posterior prolongations." *Thyone suspecta* Ludw. × 3.
9. A dendroid tentacle. *Cucumaria punctata* Ludw. × 3.
10. A peltate tentacle. *Holothuria surinamensis* Ludw. × 3.
11. A digitate tentacle. *Trochostoma boreale* (Sars). × 5.

from the body wall and is attached at the end to the radial piece of the calcareous ring. By their contraction these five muscles serve to draw the tentacles and whole anterior end of the animal back into the body cavity for protection, and they are therefore called the *retractor* muscles.

Owing to the fact that the early describers of holothurians paid little attention to internal characters, and none whatever to the microscopic deposits in the skin, it is difficult, if not impossible, to determine from one of their descriptions what species is meant. Even within the past forty or fifty years so much importance has been attached to those characters in which there is the greatest individual diversity (size, shape, color, number of tentacles, arrangement of pedicels, etc.) that the same species has been described under a number of different names. Many of our common species have two or three synonyms, some have four or five, and one has no less than eleven! As very few types of the species described by the earlier writers are now in existence, the untangling of this snarl of synonyms is no easy task. No less than eighty-eight different specific names have been given to holothurians from the shallow waters of North America; but these seem to be reducible to at most forty-seven valid species, and very probably the correct number now known is under forty-five. Since many of the names in most common use in this country are incorrect, they will be looked for in vain in this key. In order that such forms may be properly placed, the following list of synonyms is given. It is not intended as a complete synonymy of the species given in the key, but is simply an alphabetical list of names incorrectly applied, or no longer in use by the best authorities.

There are a number of such generic names, as follows:

Actinopyga Brown = *Mülleria* of the key.
Anaperus Troschel = *Thyone* " " "
Botryodactyla Ayres = *Cucumaria* " " "
Cladodactyla Brandt = *Cucumaria* " " "
Cuvieria Peron (?) = *Psolus* " " "
Embolus Selenka = *Trochostoma* " " "
Echinosoma Semper = *Eupyrgus* " " "
Leptosynapta Verrill = *Synapta* " " "

Liosoma Brandt = *Chiridota* of the key
Liosoma Stimpson = *Trochostoma* " " "
Lophothuria Verrill = *Psolus* " " "
Ocnus Forbes = *Cucumaria* " " "
Pentacta Jäger = *Cucumaria* " " "
Pentamera Ayres = *Thyone* " " "
Sclerodactyla Ayres = *Thyone* " " "
Semperia Lampert = *Cucumaria* " " "
Stereoderma Ayres = *Thyone* " " "
Synaptula Oerstedt = *Synapta* " " "
Thyonella Verrill = *Thyone* " " "
Trochinus Ayres = *Chiridota* " " "

Below are the specific names the use of which is no longer correct:

affinis (*Botryodactyla*) Ayres = *Cucumaria frondosa* of the key.
albicans (*Synapta*) Selenka = *Synapta inhærens* " " "
albida (*Cladodactyla*) Brandt = *Cucumaria populifer* " " "
albida (*Cucumaria*) Ludwig = *Cucumaria populifer* " " "
ayresii (*Ocnus*) Stimpson = *Cucumaria minuta* " " "
ayresii (*Synapta*) Selenka = *Synapta inhærens* " " "
botellus (*Holothuria*) Selenka = *Holothuria impatiens* " " "
brevis (*Chiridota*) Huxley = *Myriotrochus rinkii* " " "
carolina (*Thyone*) Selenka = *Thyone briareus* " " "
cigaro (*Thyone*) Troschel = *Thyone briareus* " " "
hispidum (*Echinosoma*) Semper = *Eupyrgus scaber* " " "
lævigatus (*Psolus*) Ayres = *Psolus phantapus* " " "
musculosum (*Thyonidium*) Ayres = *Thyone elongata* " " "
oolitica (*Molpadia*) Selenka = { partim *Trochostoma boreale* of the key. partim *Trochostoma ooliticum* of the key. }
pallidus (*Trochinus*) Ayres = *Chiridota lævis* of the key.
pauper (*Embolus*) Selenka = *Trochostoma ooliticum* " " "
pellucida (*Synapta*) { Stimpson & Kurtz } = *Synapta inhærens* " " "
pentacta { *Cladodactyla* Brandt *Holothuria* O. F. Müller } = *Cucumaria frondosa* " " "
piperata (*Pentacta*) Stimpson = *Cucumaria nigricans* " " "
pourtalesii (*Synapta*) Selenka = *Synapta vivipara* " " "
punctata (*Orcula*) Agassiz = *Orcula barthii* " " "
fallax (*Cucumaria*) Ludwig = *Cucumaria miniata* " " "
floridana (*Holothuria*) Pourtales = *Holothuria atra* " " "

fusiformis (*Cucumaria*) Desor = *Thyone unisemita* of the key
fusus (*Thyone*) Verrill = *Thyone scabra* " " "
girardii (*Synapta*) Pourtales = *Synapta inhærens* " " "
glabrum (*Thyonidium*) Ayres = *Thyone briareus* " " "
gracilis (*Synapta*) Selenka = *Synapta inhærens* " " "
grandis (*Botryodactyla*) Ayres = *Cucumaria frondosa* " " "
granulatus (*Psolus*) Ayres = *Psolus regalis* " " "
sitchæense (*Liosoma*) Brandt = *Chiridota discolor* " " "
sitchænsis (*Cuvieria*) Brandt = *Psolus fabricii* " " "
tenella (*Thyone*) Selenka = *Thyone briareus* " " "
tenuis (*Synapta*) Ayres = *Synapta inhærens* " " "
tigillum (*Chiridota*) Selenka = *Chiridota lævis* " " "
turgidum (*Molpadia*) Verrill = *Trochostoma boreale* " " "
typicum (*Chiridota*) Selenka = *Chiridota lævis* " " "
viridis (*Synapta*) Pourtales = *Synapta vivipara* " " "

The following species are so very poorly described and so little known it is impossible even to assign them as synonyms:

Holothuria tentaculata Forster, *Synapta bachei* Ayres.

The artificial key given on pp. 487, 488 is intended to include and make possible the identification of every known species of holothurian which occurs on the coasts of America, north of Mexico, in less than 100 fathoms of water. There are a few species which probably occur within these limits (as they have been taken just outside), but they are not included in this key. The holothurians of Florida and the Gulf coast and those of the Pacific coast are almost unknown, and the geographical range of even our most common species is very imperfectly known. It has therefore been thought best to give as exactly as possible the localities where the various species have been taken. There are five species included in the key which are new to science and the descriptions of which have not yet been published; but descriptions and figures are now in press of two of these forms, which were collected in Puget Sound in 1896 and 1897 by the zoölogists of Columbia University. These are *Psolus chitonoides* Clark and *Cucumaria lubrica* Clark. The third species is *Cucumaria curata* Cowles, also from the Pacific coast. Mr. H. P. Cowles is now engaged in a study of the life history of this species, and in advance of his own publication he has very kindly given me the name he has

Artificial Key to the Genera of North-American Holothurians.

- Without pedicels or papillæ
  - Without respiratory trees (Synaptidæ)
    - Calcareous deposits in skin, consisting of anchors and plates (Figs. 12 and 13) . . . . Synapta
    - Calcareous deposits in skin, wheels with 6 spokes (Fig. 14), collected in little heaps . . . . Chiridota
    - Calcareous deposits in skin, scattered wheels with about 19 spokes . . . . Myriotrochus
  - With respiratory trees (Molpadiidæ)
    - Tentacles simple, unbranched; calcareous ring without posterior prolongations . . . . Eupyrgus
    - Tentacles digitate (Fig. 11); calcareous ring with posterior prolongations.
      - Caudal portion of body short, abrupt (Fig. 1); calcareous deposits, when present, more or less imperfect tables, reddish-brown ellipses, or both . . . Trochostoma
      - Caudal portion of body long, tapering (Fig. 2); calcareous deposits, perforated disks or tables with a narrow spire . . Caudina

ARTIFICIAL KEY TO THE GENERA OF NORTH-AMERICAN HOLOTHURIANS (*Continued*).

With pedicels or papillæ, or both	Tentacles dendroid (Fig. 9). Retractor muscles present. (Dendrochirotæ)	10 tentacles .	Ventral surface flattened to form a creeping sole, on which the pedicels are arranged in 3 longitudinal series.	Pedicels wanting on the dorsal surface	Psolus
				Pedicels numerous all over the dorsal surface	Thyonepsolus
			Ventral surface not notably flattened.	Pedicels numerous all over the body, not at all arranged in rows on the ambulacra	Thyone
				Pedicels in rows on the ambulacra; scattered or wanting on the interambulacra	Cucumaria
		15 tentacles			Orcula
		20 tentacles			Thyonidium
	Tentacles peltate (Fig. 10). Retractor muscles wanting. (Aspidochirotæ)	Anal teeth present; genital glands in a single tuft beside the mesentery			Müllleria
		Anal teeth wanting	Genital glands in a tuft on each side of the mesentery . . .		Stichopus
			Genital glands in a single tuft on the left side of the mesentery		Holothuria

adopted and the diagnostic characters of this interesting little holothurian. The remaining two species are very curious and noteworthy ones from the coast of California, collected during the summer of 1900 by Mr. Benjamin Thomas. They are *Thyone rubra* Clark and *Thyonepsolus nutrians* Clark. Descriptions of these two species are now in press. Each of these five species bears at present only a *nomen nudum*, but it has seemed best to include them, nevertheless, in order to make the key as complete as possible.

Key to the Species under each Genus.

Synapta.

Radial pieces of calcareous ring perforated for passage of the nerve. (Fig. 5)

- Viviparous; 100 mm. long; reddish-brown or greenish, flecked with white; lives in seaweed *S. vivipara* (Oerst.)

  Biscayne Bay, Florida; Bermuda, Jamaica; Brazil.

- Not viviparous; larger, 250 mm.; white, yellowish, or pale pinkish; lives buried in sand or mud . . . . *S. inhærens* (O. F. Müll.)

  Widely distributed in Northern Hemisphere; Maine to South Carolina in Western Atlantic; Puget Sound, southward on Pacific coast. Also Mediterranean, Eastern Atlantic, North Sea, and Arctic Ocean.

Radial pieces of calcareous ring, not perforated but merely notched (Fig. 6); 100 mm.; rosy red . . . . *S. roseola* (Verr.)

Occurs under loose rocks or buried in the sand. Southern side of Cape Cod, Buzzards Bay, Long Island Sound, and Bermuda.

Chiridota.

Wheel papillæ very numerous, scattered over all the interambulacra; besides wheels there are many small slightly curved rods *C. rotifera* (Pourt.)

Viviparous; 100 mm. long; deep flesh color, wheel papillæ white; under stones and loose rocks, and in sand; Key West, Biscayne Bay, Bermuda, Jamaica, and Brazil.

Wheel papillæ in rows of 20–30 in each dorsal interambulacrum and 3–12 in each ventral one; North Atlantic coast . . . *C. laevis* (Fabr.)

Wheel papillæ in only three interambulacra; Alaskan species *C. discolor* Esch.

These last two species are practically indistinguishable, and further study will probably show them to be identical. Occur under rocks, or in sand or mud in comparatively shallow water; may reach a considerable size; color very variable, from gray to pink.

Myriotrochus.

Small, 50–60 mm.; blackish or dusky; tentacles light . . . *M. rinkii* Steens.

Circumpolar; northeastern America as far south as Labrador. Occurs in water not over 300 fathoms deep.

Eupyrgus.

Very small, 10 mm.; grayish . . . . *E. Scaber* Ltk.

Labrador, Greenland, Spitzbergen, Kara Sea. At depths of 4–240 fathoms, generally on muddy bottom.

Trochostoma (Fig. 1).

Deposits wanting; integument smooth and leathery; body spindle-shaped, 100 mm.; yellowish or reddish-white with reddish-brown patches . . . . *T. arenicola* Stimp.

Coast of southern California.

Deposits, reddish-brown, concentric ellipses (Fig. 18) usually in such quantities as to give part or all of the animal a dark red color; skin grayish.

- With colorless calcareous tables, more or less imperfect (Fig. 17), in addition to the ellipses *T. boreale* (Sars)

  An Arctic species, reported from the coast of Florida, Lesser Antilles, and Maine. Verrill's *Molpadia turgidum*, probably this species, was taken at various points on the New England coast up to the Gulf of St. Lawrence, in 40–100 fathoms.

- Without tables . . . . *T. ooliticum* (Pourt.)

  Boston, Block Island, Boon Island. Very possibly identical with the preceding.

Caudina (Fig. 2).

Medium size, 50–100 mm.; about one-third consisting of the long, narrow tail . . . . *C. arenata* (Gould)

New England coast, Revere Beach, Grand Manan (?), Chelsea, and Vineyard Sound. Occurs buried in the sand in shallow water.

Psolus (Figs. 3 and 4).

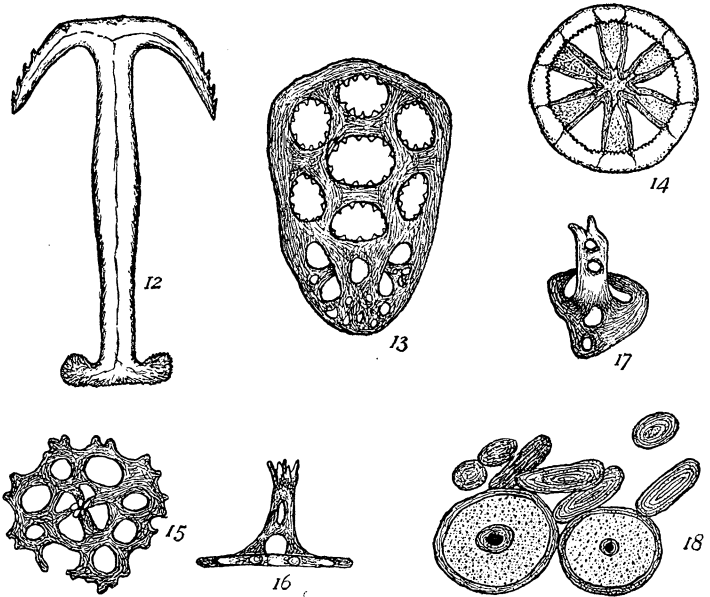
Body subcylindrical; anal region elongatedly conical caudiform; pedicels in three complete rows on ventral surface (Fig. 4).

- Dorsal perisome without large plates; with numerous minute perforated plates and round granules . . . . *P. regalis* Verrill

  Banks of Newfoundland, in thirty fathoms.

- Dorsal perisome with large granulated scales, imbricated . . . . *P. phantapus* (Struss.)

  North Atlantic and Arctic oceans; on American coast as far south as Massachusetts; occurs from low water to 130 fathoms.



FIGS. 12–18.

12. Anchor of *Synapta inhærens* (O. F. Müll.). × 225.
13. Plate of the same species. × 225.
14. Wheel of *Chiridota rotifera* (Pourt.). × 225.
15. Table of *Caudina arenata* (Gould). Seen from above. × 105.
16. The same; seen from the side. × 105.
17. Table of *Trochostoma boreale* (Sars). × 105.
18. Reddish-brown deposits of *Trochostoma boreale* (Sars). × 105.

Body depressed oval, chiton-shaped (Fig. 3); anal region not prolonged; pedicels forming complete rows only on sides of ventral surface; dorsal surface covered with large imbricated scales; color generally some shade of orange or red.

Dorsal scales with fine granulations; sole with scattered, irregular, reticulate plates; 130 mm. *P. squamatus* (D. & K.)

North Atlantic; common on New England coast in shallow water. Pacific Grove, Cal. (?)

Dorsal scales with coarse granules; sole with reticulate cups or spheres . . *P. fabricii* (D. & K.)

Smaller than preceding, but possibly identical with it; eastern North America from Massachusetts to Greenland; also on Alaskan coast.

Dorsal scales, without evident granules; sole with crowded knobbed, perforated plates; 65 mm. . . . . *P. chitonoides* Clark

Puget Sound.

Thyonepsolus.

Size small, 20 mm. long by 8 wide; red; deposits, reticulated cups and very irregular perforated plates; carries the young on the back. On rocks along shore at Pacific Grove, Cal. . . . *T. nutrians* Clark

Cucumaria.

Pedicels scattered more or less on the interambulacra.

See also *C. miniata* in the next section.

Size large, up to 600 mm.; deposits, when present, irregular smooth perforated plates *C. frondosa* (Gun.)

Brown; practically circumpolar; on Atlantic coast of America south to Florida; on Pacific coast, to Lower California (?).

Size small, 40–50 mm.; deposits, irregular knobbed buttons, sometimes with four symmetrically placed holes, but more often with several scattered ones . . . . *C. lubrica* Clark

Pale brownish gray; Puget Sound.

Size very small, 15–20 mm.; deposits rather thick, smooth buttons, with from 1–9 holes and, in the ventral wall, a few much larger plates with much larger holes . . *C. curata* Cowles

Black; "eggs laid and cared for by mother; brooded under ventral surface." "Pacific Grove, Cal., and possibly in region near San Francisco."

Pedicels present only on the ambulacra, and there generally in one or two rows.

Deposits minute, reticulate cups and roundish or oval buttons with four holes *C. quinquesemita* Sel.

Mendocino, Cal. (Other specimens were labeled "Charleston," but this is probably a mistake.)

Deposits scattered irregular perforated plates, with one end drawn out as a spire or dentate process . . . . *C. albida* Sel.

Yellowish (white in alcohol) with brown spots; 80 mm. Mendocino and Pacific Grove, Cal.

Deposits polygonal plates with 25–40 holes and a central sharp spine . . . . . *C. populifer* (Stimp.)

130 mm.; Sitka and Puget Sound.

Deposits an inner layer of narrow oblong plates with two or three rows of holes and an outer layer of tables . . . . *C. calcigera* (Stimp.)

120 mm.; Massachusetts, Labrador, Greenland, and Arctic Ocean. Pacific Grove, Cal.

Deposits irregular spinous rods or spicules *C. nigricans* (Brandt)

Dusky yellowish-brown; 60 mm.; Sitka and Puget Sound.

Deposits a very crowded inner layer of hollow fenestrated ellipses and an outer layer of small reticulate cups or spheres . . . *C. chronhjelmi* Théel

White; 70 mm.; Vancouver Island and Puget Sound. Pacific Grove, Cal.

Deposits roundish perforated plates . *C. minuta* (Fabr.)

Clear brownish; 10 mm.; Grand Manan to Arctic Ocean.

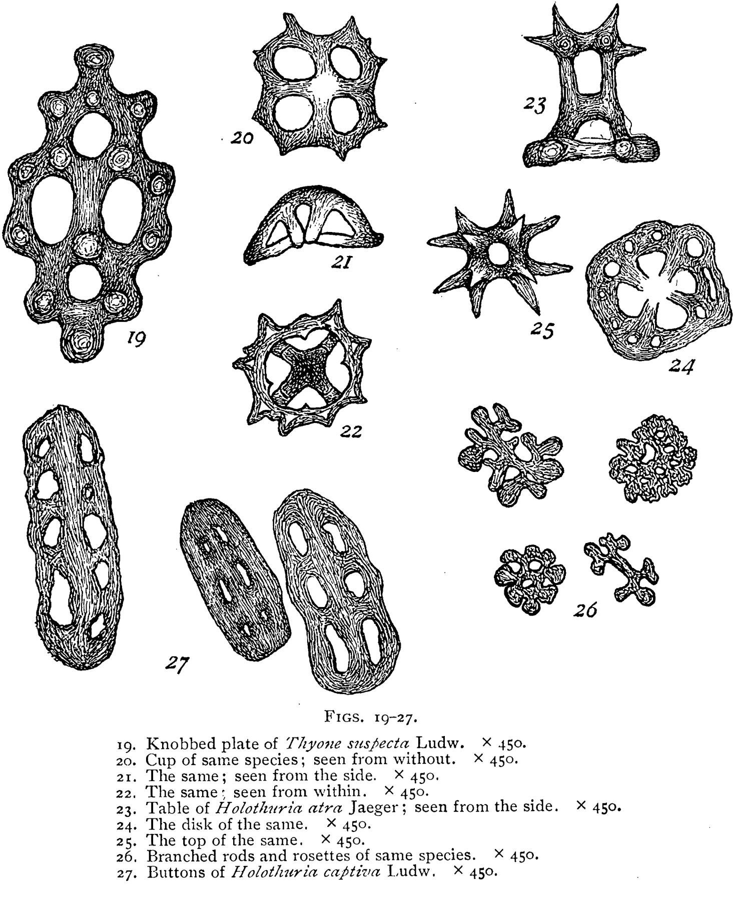
Pedicels present only on the ambulacra, and there generally in one or two rows.

Deposits "in numerous inseparable perforated layers, their true shape not fully clear" *C. pulcherrima* (Ayres)

Eastern United States from Vineyard Sound south to South Carolina. This species needs a reëxamination.

Deposits crowded, thick, knobbed buttons or plates with few or many perforations, and one end drawn out into a thorny spine or process *C. miniata* (Brandt)

Pinkish-white; 40 mm.; Alaska and Pacific Grove, Cal. (?). This species is not well defined. Ludwig thinks it identical with *C. albida* Sel., but there are two species at Pacific Grove, Cal., one of which is apparently *albida*, and the other is clearly distinct from it, but answers to the description of *miniata*. There are pedicels, however, on all of the interambulacra in the specimens from Pacific Grove.



Figs. 19–27.

19. Knobbed plate of *Thyone suspecta* Ludw. × 450.
20. Cup of same species; seen from without. × 450.
21. The same; seen from the side. × 450.
22. The same; seen from within. × 450.
23. Table of *Holothuria atra* Jaeger; seen from the side. × 450.
24. The disk of the same. × 450.
25. The top of the same. × 450.
26. Branched rods and rosettes of same species. × 450.
27. Buttons of *Holothuria captiva* Ludw. × 450.

Thyone.

Deposits in body wall wanting . . . . *T. briareus* (Less.)
Dark brown, almost black; 150 mm.; in mud, Cape Cod to Texas.

Deposits in the form of tables . . . . *T. scabra* Verrill
Brownish; 50 mm.; coast of New England to Chesapeake Bay.

Deposits small reticulate cups and uneven oval buttons with four holes *T. gemmata* (Pourt.)
Body spindle-shaped, dusky brown; North Carolina to Brazil (?).

Deposits unperforated rods . . . . *T. elongata* (Ayres)
Banks of Newfoundland, in thirty fathoms; Massachusetts Bay (?).

Deposits crowded oval buttons with four holes . . . . *T. unisemita* (Stimp.)
Brownish-gray; 60–75 mm.; coast of New England from Nantucket northward.

Deposits buttons with four holes, and very numerous large complex tables . . . . *T. rubra* Clark
Red above, whitish below; 20 mm.; viviparous; Pacific Grove, Cal.

Orcula.

Size medium, 65 mm.; brownish; deposits wanting . . . *O. barthii* Troschel
Labrador, Greenland, and the Arctic Ocean.

Thyonidium.

Size small, 15 mm.; pale yellowish; deposits few . . . *T. productum* (Ayres)
Eastport and Grand Manan.

Mülleria.

Tentacles 20; deposits tables and buttons . . . . *M. parvula* Sel.
Chestnut-brown; 50 mm.; Florida.

Tentacles 25–30; tables and buttons wanting; deposits small branched rods . . . . *M. agassizii* Sel.
Light brown mottled with darker; 300 mm.; Florida and West Indies.

Stichopus.

Tables with round perforated disk; no buttons . . . . . *S. badionotus* Sel.
Olive green or olive brown; 200 mm.; Florida.

Tables without disk; no buttons . . . . *S. sitchænsis* (Brandt)
90 mm.; Alaska. The status of this species is doubtful.

Tables with well-developed disks; numerous buttons with nine pairs of holes . . . . *S. californicus* (Stimp.)
Brown; 300 mm.; coast of California, Puget Sound.

Holothuria.

Papillæ on dorsal, pedicels on ventral surface.	Deposits tables and very numerous small irregular perforated plates . . . . . . *H. atra* Jäger Dark brown, 300 mm.; widely distributed in the tropics; Florida.
	Deposits tables and two kinds of perforated buttons . . . . *H. rigida* Sel. Olive brown; 70 mm.; Florida (also Zanzibar and Society Islands).
Papillæ on both dorsal and ventral surfaces; no pedicels; deposits tables and one kind of perforated buttons.	Disk of tables with a smooth margin *H. impatiens* (Forsk.) Dark purplish or grayish, more or less blotched with darker; 150 mm.; very widely distributed in the warmer seas; Florida.
	Disk of tables with twelve prominent horizontal teeth on margin . . . . *H. princeps* Sel. Dark brown; 120 mm.; Florida.

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(*c*) *Proc. Bost. Soc. of Nat. Hist.* Vol. x. 1864.

(*d*) *Trans. Conn. Acad. of Sci.* Vol. i, pt. ii. 1867–71.

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(*f*) *Proc. U. S. Nat. Museum.* 1879 and 1885.

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